U.S. Army
Chemical Materials Agency

Project Manager for
Non-Stockpile Chemical Materiel

Plan for Destruction of
Chemical Warfare Materiel
at Dugway Proving Ground, Utah,
Using the Explosive
Destruction System

Final
Revision 2

March 2009

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Explosive Destruction System at Dugway Proving Ground

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EXECUTIVE SUMMARY

The U.S. Army Chemical Materials Agency (CMA) is responsible for destroying United States chemical warfare materiel. The Project Manager for Non-Stockpile Chemical Materiel (PMNSCM) is responsible for destroying non-stockpile chemical materiel, including recovered chemical warfare materiel (CWM).

This Destruction Plan describes procedures for destroying and treating CWM items at Dugway Proving Ground (DPG), Utah, using the Explosive Destruction System (EDS). DPG has requested PMNSCM to destroy chemical-filled munitions and chemical agent sample items currently stored in Igloo G at DPG. The munitions are overpacked in multiple round containers (MRCs) and propellant charge cans (PCCs).

This Destruction Plan provides a scope of effort using the EDS at DPG to safely destroy CWM consisting of chemical-filled or empty munitions, containers (cylinders, bottles, ammunition cans), and miscellaneous chemical samples. Chemical agent fills to be treated consist of distilled sulfur mustard (HD), thickened mustard (HT), sarin (GB), soman (GD), and O-ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate (VX).

This Destruction Plan is based on procedures in the EDS Standing Operating Procedures (SOPs) and provides a description of the operations and sampling strategy for this operation. The procedures described in this Plan will ensure the operation is conducted in a safe, secure, and environmentally sound manner.

DPG is the lead for public outreach activities. DPG will coordinate with the PMNSCM Public Outreach and Information Office to exchange information. The Utah Department of Environmental Quality, Department of Solid and Hazardous Waste will provide environmental regulatory oversight of the EDS operations at DPG. The EDS operation

will be conducted under a Stipulation and Consent Order issued by the Utah Solid and Hazardous Waste Control Board.

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SECTION 1
INTRODUCTION

The Project Manager for Non-Stockpile Chemical Materiel (PMNSCM) will use the Explosive Destruction System (EDS) to safely destroy munitions that contain distilled sulfur mustard (HD), or are empty (do not contain chemical fill), as well as miscellaneous chemical samples that contain O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothioate (VX), sarin (GB), soman (GD), thickened mustard (HT), and HD. The items are currently stored in Igloo G at Dugway Proving Ground (DPG), Utah.

1.1 Purpose

This Destruction Plan provides a scope of effort using the EDS at DPG to safely treat/destroy chemical warfare materiel (CWM) consisting of chemical-filled or empty munitions, containers (cylinders, bottles) and miscellaneous chemical samples. Chemical agent fills to be treated consist of mustard (HD/HT), GB, GD, and VX.

1.2 Items to Be Destroyed

The items to be destroyed are listed in **Tables 1-1**, **1-2**, and **1-3**. The items include 4.2-inch mortars, a 105mm projectile, 155mm projectiles, a 6-inch projectile, and miscellaneous chemical samples. **Annex C** contains background information from the *Old Chemical Weapons Reference Guide* (SciTec, 1998) on the type of munitions that will be destroyed. This information is provided for readers who may not be familiar with the specifications for these munitions.

Destruction of the items will be conducted in campaigns based on the type of item.

Table 1-1. Summary of Data for Non-Stockpile Munitions to Be Destroyed

GMID#	Munition	MARB X-ray Interpretation	MARB PINS Interpretation	MARB Interpretation Date	Overpack
DPG-94-003	155mm projectile	No fuze, burster present, possible POP bandage on nose	Weak S; possible residue; not CWM; suspected GB	8/29/2001	PCC
DPG-94-004	105mm projectile	No visible fill; no fuze	No key elements; possibly empty, not CWM	8/29/2001	PCC
DPG-94-008	6-inch projectile	No fuze, burster present	No key elements; possibly empty, not CWM; suspected GB	8/29/2001	PCC
DPG-94-044	155mm projectile	No visible fill; no fuze; solid substance in burster well	No key elements; possibly empty, not CWM	8/29/2001	PCC
DPG-94-045	155mm projectile	No visible fill; burster well damaged	Possible weak Cl; possibly empty; not CWM	8/29/2001	PCC

Notes:

Cl = chlorine
CWM = chemical warfare materiel
GB = sarin
MARB = Materiel Assessment Review Board
mm = millimeter
PCC = propellant charge can
PINS = portable isotopic neutron spectroscopy
POP = plaster of Paris
S = sulfur

Table 1-2. Summary of Data for Stockpile Munitions to Be Destroyed

No.	Item	Agent/Quantity	MRC
JJ028S	4.2-inch mortar	HD/2.7kg (2.1L)	7 x 27
JJ031S	4.2-inch mortar	HD/2.7kg (2.1L)	7 x 27
JJ052S	4.2-inch mortar	HD/2.7kg (2.1L)	7 x 27
JJ058S	4.2-inch mortar	HD/2.7kg (2.1L)	7 x 27
JJ065S	4.2-inch mortar	HD/2.7kg (2.1L)	7 x 27
JJ074S	4.2-inch mortar	HD/2.7kg (2.1L)	7 x 27
JJ076S	4.2-inch mortar	HD/2.7kg (2.1L)	7 x 27
JJ079S	4.2-inch mortar	HD/2.7kg (2.1L)	7 x 27

Notes:

HD = distilled sulfur mustard
Kg = kilogram
L = liter
MRC = multiple round container

Table 1-3. Summary of Data for Miscellaneous Chemical Sample Items to Be Destroyed[a]

WDTCID No.	Container Type	Agent/Quantity[b]
98541C	SS Cylinder	VX/103 mL
98544C	SS Cylinder	VX/86 mL
98512C	SS Cylinder	GB/384 mL
98513C	SS Cylinder	GB/381 mL
98540C	SS Cylinder	VX/396 mL
98542C	SS Cylinder	VX/378 mL
98543C	SS Cylinder	VX/379 mL
98510C	SS Cylinder	GB/181 mL
98534C	PCC	GB/470 mL
98550C	Cylinder	GD/348 mL
98551C	Cylinder	GD/348 mL
98556C	PCC	GD/498 mL
98515C	PCC	GB/900 mL
98516C	PCC	GB/900 mL
98533C	PCC	GB/700 mL
98535C	PCC	GB/248 mL
98548C	PIG	GD/498 mL
98549C	ICC Cylinder	GD/278 mL
98511C	SS Cylinder	GB/39 mL
98527C	SS Cylinder	GB/105 mL
98528C	SS Cylinder	GB/100 mL
98529C	SS Cylinder	GB/100 mL
98537C	SS Cylinder	GB/146 mL
98536C	ICC Cylinder	GB/2,067 mL
98507C	PCC	HT/3,296 mL
98523C	SS Cylinder	GB/225 mL
98524C	SS Cylinder	GB/225 mL
98525C	SS Cylinder	GB/225 mL
98526C	SS Cylinder	GB/225 mL
98514C	SS Cylinder	GB/121 mL
98517C	SS Cylinder	GB/225 mL
98518C	SS Cylinder	GB/225 mL
98520C	SS Cylinder	GB/223 mL

Table 1-3. Summary of Data for Miscellaneous Chemical Sample Items to Be Destroyed[a] (Continued)

WDTCID No.	Container Type	Agent/Quantity[b]
98522C	SS Cylinder	GB/225 mL
98519C	SS Cylinder	GB/223 mL
98521C	SS Cylinder	GB/225 mL
82341C	ICC Cylinder	GB/450 mL
82375C	ICC Cylinder	GB/503 mL
82380C	ICC Cylinder	GB/332 mL
82397C	ICC Cylinder	GB/482 mL
82403C	ICC Cylinder	GB/382 mL
82414C	ICC Cylinder	GB/411 mL
82419C	ICC Cylinder	GB/415 mL
82421C	ICC Cylinder	GB/490 mL
82423C	ICC Cylinder	GB/474 mL
82346C	ICC Cylinder	GB/296 mL
82370C	ICC Cylinder	GB/440 mL
98530C	M2A1 Can	GB/868 mL
Serial Number F463286	DOT Bottle (46 in. x 7.5 in.)	HD/Approximately 7 gal
Serial Number F463289	DOT Bottle (46 in. x 7.5 in.)	HD/Approximately 7 gal

Notes:

[a] Some of the miscellaneous chemical sample items may not be processed in the EDS at DPG if they can be used onsite or offsite for other U.S. Army purposes, and they will be removed from the final list before operations begin.

[b] Quantity values presented are based on DPG archived data.

DOT = Department of Transportation
GB = sarin
GD = soman
HD = distilled sulfur mustard
HT = thickened mustard
ICC = Interstate Commerce Commission
kg = kilogram
mL = milliliter
N/A = not applicable
PCC = propellant charge can
SS = stainless steel
VX = O-ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate
WDTCID = West Desert Test Center Identification Number

1.3 Fill Materials

The Materiel Assessment Review Board (MARB) has assessed the status of the explosives and chemical agent fill of the recovered non-stockpile munitions that will be destroyed. **Table 1-1** contains results of the MARB determinations. These munitions have been assessed as empty, with no chemical fill.

The stockpile items are filled with HD.

The miscellaneous chemical samples are filled with VX, GB, GD, HT, and HD.

1.4 Approval Process

Plans for using the EDS at DPG will be submitted to the Utah Department of Environmental Quality (UDEQ) Division of Solid and Hazardous Waste (DSHW) for approval before destruction begins. In addition, PMNSCM will coordinate with the U.S. Department of Health and Human Services (DHHS); and DPG will coordinate with the UDEQ, as well as the Department of Defense Explosives Safety Board (DDESB). Concurrence/approval by DHHS, UDEQ, and the other agencies will be obtained before implementing this Destruction Plan.

1.5 Historical Precedence for Destruction

Prior to the EDS, the only method available for destroying armed and fuzed chemical agent-filled munitions or items was open detonation. In this method, a quantity of explosives sufficient to destroy the munition or item and its chemical fill were placed around the munition or item and detonated. The resulting detonation produced sufficient heat to destroy explosives and chemical agent inside the munition or item.

Concerns over collateral damage due to noise, blast, and fragmentation caused by open detonation led the Army to develop the EDS. The EDS is an explosion and vapor containment chamber in which the munition or item is placed for destruction. Unlike open detonation, the EDS does not use explosives as the primary means to destroy the chemical agent. During EDS operations, explosives are used to open the munition or item, expose the chemical agent, and destroy the fuze and burster (if applicable). The chemical agent is then treated using chemical neutralization.

The EDS has been extensively tested and used to treat items similar to the ones that will be destroyed using this Plan. To date, the EDS technology has been used to safely and successfully destroy more than 1,500 items. In 2004, two GB-filled and 13 mustard-filled recovered munitions, as well as 7 mustard-filled Department of Transportation (DOT) cylinders, were successfully treated at DPG using an EDS.

1.6 Site Description

The items are currently stored in Igloo G at DPG. **Figure 1-1** shows the location of DPG and **Figure 1-2** shows the location of the EDS operation site. The EDS will be set up near Igloo G at the same location as the previous EDS operation at DPG in 2004. This location minimizes the distance the items must be moved, while maintaining the prescribed explosive areas around both Igloo G and the EDS.

1.7 Emergency Planning and Contingency Operations

The site-specific *Safety, Health, and Emergency Response Plan* (SHERP) located in **Annex I** of this Destruction Plan contains information on support operations such as medical support and firefighting. The SHERP also describes actions to be taken to protect workers and the public in the event of chemical agent accident or incident.

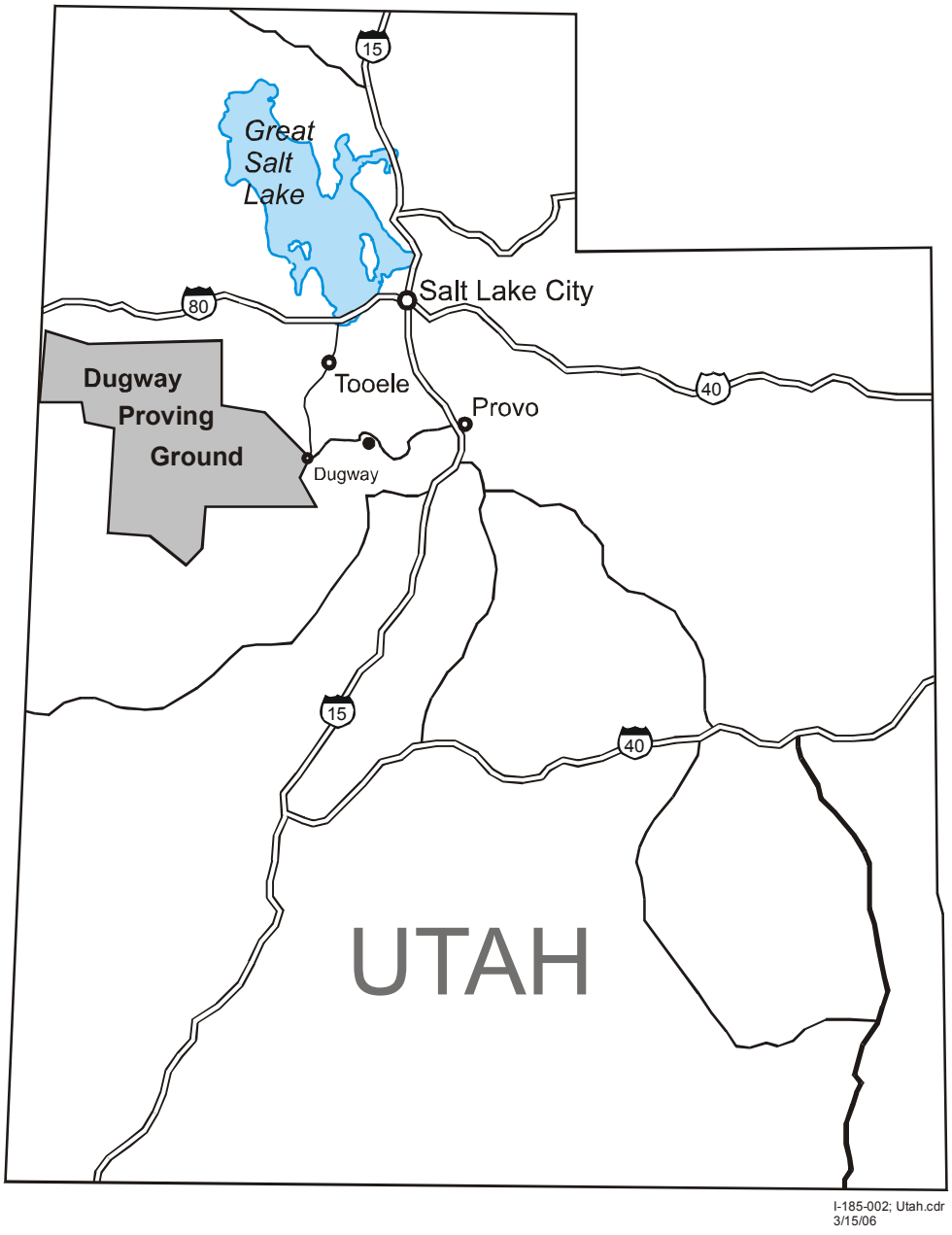

Figure 1-1. Location of DPG

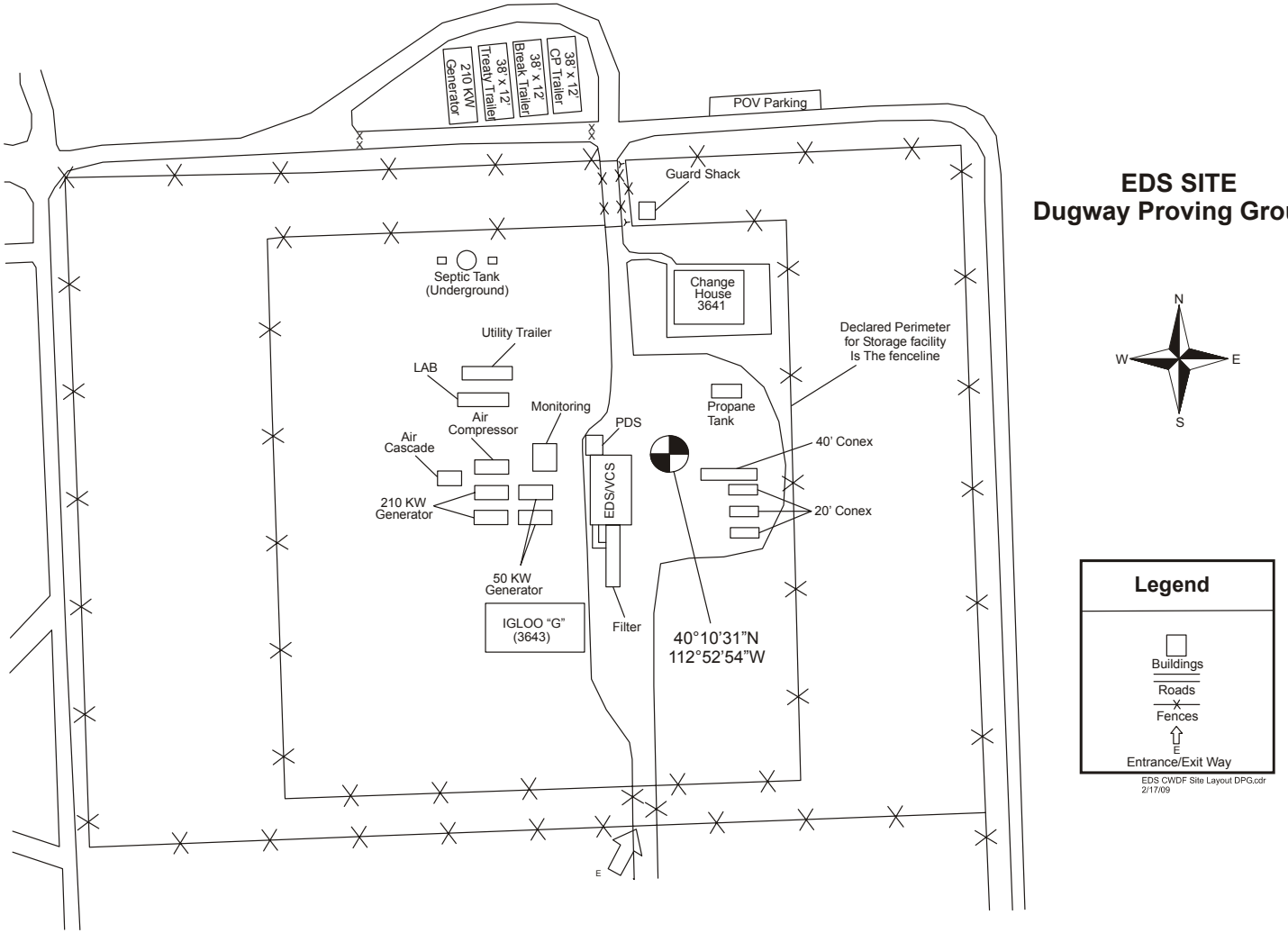

Figure 1-2. DPG EDS Location and Site Layout

1.8 Air Monitoring

Air monitoring will be performed in accordance with the EDS *Site-Specific Monitoring Plan*, **Annex E** to this Destruction Plan. Edgewood Chemical Biological Center (ECBC) will provide personnel and equipment for air monitoring of chemical agents. Air monitoring objectives include ensuring that worker and public safety and health are maintained by providing adequate environmental monitoring as specified in Army Regulation (AR) 385-10 and the Department of the Army *Implementation Guidance Policy for Revised Airborne Exposure Limits for GB, GA, GD, GF, VX, HD, and HT*.

1.9 DPG Non-Stockpile Chemical Materiel Project (NSCMP) Site Support

The following information outlines site support services that will be provided by DPG and NSCMP personnel to conduct EDS operations at DPG.

1.9.1 Equipment (DPG to provide).

- *Forklift.* A 12-ton forklift will be required to facilitate movement of equipment at the EDS site during setup and demobilization efforts.

- *Scissor Lift.* Two scissor lifts with working platform capable of accommodating two workers will be used to load and unload carbon filters into filtration system.

- *Crane.* A 40-ton crane (possibly) will be required to assist in setup of the Environmental Enclosure (EE).

1.9.2 Utilities/Facilities (DPG to provide).

- *Diesel Fuel.* Diesel fuel is required to power primary generators that, in turn, will power the site. Delivery of approximately 150 gallons of diesel fuel is required daily (7 days/week) for the entire operation, including 3 weeks before and 2 weeks after operations for setup and demobilization.

- *Water and Ice.* Potable water and ice are needed for the crew. Non-potable water is needed to complete EDS rinse operations. Approximately 40 gallons are needed per detonation. Approximately 100 pounds of ice are required daily.

- *Sanitation.* Two port-a-pots with wash stations, including provisions to have the facilities maintained/serviced.

- *Telephone.* Two hard lines are required with one having fax capability.

- *LAN.* The LAN is required for e-mail and document transfer capability.

- *Igloo G Shower and Toilet Facility.* The Igloo G shower and toilet facility should be cleaned and made available for the crew prior to arrival onsite and should be regularly cleaned during operations.

- *Trash Dumpster.* The dumpster will be located onsite and cleared of trash weekly.

1.9.3 Security (DPG to provide).

- *Security Force.* A security force will be onsite 24/7 during setup, operations, and demobilization efforts.

- *Access to DPG and Igloo G Area.* Blanket/long-term visitor passes for crew will be required for access to DPG and Igloo G.

- *Class V.* Receipt, storage, inventory, and transportation from storage to operations site.

1.9.4 Site Preparation/Maintenance (DPG to provide).

- *Site Maintenance.* Site maintenance will include pest control and weed/grass control.

1.9.5 Operations Support (DPG to provide).

- *One Full-Time Site Support Person.* One full-time support person will be required during operations to coordinate with range control, security, weather, hazardous material (HAZMAT), medical, explosive ordnance disposal (EOD), and emergency response personnel. Assume 40 hours per week, although the support person would not necessarily be needed onsite during maintenance activities.

- *Medical Support.*

  - *Onsite.* Onsite medical support will be available to check vitals (heart rate, blood pressure, etc.) and treat both chemical- and nonchemical-related injuries.

- *Onpost.* Onpost medical support will be available to treat both chemical- and nonchemical-related injuries.

- *Offpost.* Offpost medical support will be available to treat both chemical- and nonchemical-related injuries. NSCMP can provide the required training if necessary.

- *Fire Department.* The fire department will participate in pre-operational survey and be on-call for emergency response.

- *Treaty.* A dedicated treaty trailer with camera may or may not be needed.

- *EOD Support.* EOD support will be provided for movement of explosives (donor charges), in approved vehicle, from their storage location to the EDS site and also for transport of the munitions/items to be destroyed. This assumes DPG will provide donor charge storage in either Igloo F or K.

- *Igloo G.* First entry monitoring will be conducted for Igloo G.

- *Hazardous Waste Management.* Hazardous waste management includes preparation of hazardous waste labeling for drums and carbon filters; transport and storage of all EDS generated waste from the EDS site to a less than 90-day waste storage area pending shipment to an offsite permitted treatment, storage, and disposal facility (TSDF) for final disposition; additional sampling at the less-than 90-day storage facility if necessary.

- *Mask Issue.* Masks or escape bottles will be provided for visitors to the site including Organization for the Prohibition of Chemical Weapons (OPCW) and/or DSHW.

1.9.6 Planning/Permitting (PMNSCM to provide).

- *Destruction Plan.* PMNSCM will prepare and obtain approval of the Destruction Plan by DPG, DSHW, and DHHS. The Destruction Plan includes the following plans: operations; air monitoring; sampling and analysis; health and safety; waste management; inspection; chemical agent worker population limit excursion; and, project closeout.

- *Stipulation and Consent Order.* PMNSCM reviews and obtains agreement with DPG.

- *Site Safety Submission.* PMNSCM will prepare and obtain approvals by the U.S. Army Technical Center for Explosives Safety (USATCES) and DDESB.

1.9.7 Operations (PMNSCM to provide).

- *Crew.* The crew will consist of all necessary operators, safety, monitoring, and laboratory personnel to conduct site setup, pre-operational survey, operations, and demobilization, including overtime and travel expenses (for example, lodging, per diem).

- *Equipment.* This includes transportation and setup of equipment necessary to conduct operations including EDS, EE, air monitoring equipment and structure, generators, air compressors, Personnel Decontamination Station (PDS), laboratory, video cameras, computers, printers, etc.

- *Trailers.* PMNSCM will provide rental of Command Post Trailer and Break Trailer.

- *Consumables.* Consumables will include items necessary to conduct operations, including decontamination solution, treatment reagents, EDS O-ring and Grayloc® seal, Fragment Suppression Systems (FSSs), bottled gas, waste drums, carbon and high efficiency particulate air (HEPA) filters, explosives, liquid and vapor sample containers.

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SECTION 2
SYSTEM DESCRIPTION

This section presents a physical description of the EDS Phase 2 units and describes the support systems required for operations. **Table 2-1** details the physical characteristics of the EDS Phase 2 units.

2.1 EDS System Description

Destruction operations at DPG will be performed with an EDS Phase 2 unit. The EDS is a trailer-mounted system designed to safely access and treat the chemical agent inside an explosively configured munition(s) while at the same time destroying the explosive components of the munition(s). The main subsystem of the EDS is a stainless steel (SS) pressure chamber where the explosives are detonated and the chemical fill is treated. Other subsystems include a system for collecting liquid and vapor samples and plumbing for adding neutralization reagent and for draining the treatment waste.

2.1.1 Hardware. The EDS Phase 2, depicted in **Figure 2-1**, is comprised of the following subsystems:

- Trailer Subsystem
- Containment Vessel Subsystem
- Lift Assist Subsystem
- Clamp Hanger Subsystem

Table 2-1. EDS Phase 2 Physical Characteristics

Component	Characteristic
Trailer Subsystem	
Gross Weight of Trailer	About 57,300 pounds
Dimensions of Trailer	39.5 feet long x 8.5 feet perimeter frame dual-axle, single-drop trailer with a fold-up wing
Dimensions of Trailer Pan	Approximately 154.75 inches long x 69 inches wide x 2.34 – 5 inches deep (about 166 gallons)
Dimensions of Debris Pan	Approximately 52 inches long x 30 inches wide x 11.5 inches deep (about 50 gallons)
Working Surface of the Trailer	About 42 inches above the ground
Leveling Jacks	Four hydraulic leveling jacks, two between the dual wheels and at the front corners of the trailers
Access to Trailer	Four fold-down steps on each side midway to the front and one set of steps for the rear
Safety Railings	4.5-foot high safety rail surrounds the trailer
Additional Feature	Four fold-down platform extensions for additional work area and accessibility
Containment Vessel Subsystem	
Outside Length of the Containment Vessel	Approximately 63 inches
Outside Diameter of the Containment Vessel	Approximately 35 inches
Inside Length of the Containment Vessel	Approximately 56 inches
Inside Diameter of the Containment Vessel	Approximately 29 inches
Side Wall Thickness	Approximately 3 inches
Rear Wall Thickness	Approximately 6.5 inches
Assembly Weight	18,000 pounds
Design Volume	About 160 gallons
Working Volume	112 gallons
Maximum Explosive Rating[a]	4.8 pounds TNT equivalent
Munition Size Capacity	
Maximum Diameter	9 inches
Maximum Length	39 inches
Chemical Fill Capacity	50 pounds or less
Maximum Munitions or Items Load	Supports 1 to 6 munitions per detonation
Number of Paddles	Two welded inline T-shaped paddles to aid in agitation, each 19 inches long x 4 inches wide x 3-1/16 inches tall
Protection Plates	Four stainless steel blast protection plates
Access Door to the Interior of the Vessel	9-inch thick door
External Heaters	Six 7.5-kW, 480-volt band heaters
Lift Assist Subsystem	Overhead jib crane (mounted to trailer) with intelligent lift device and an FSS lifting tool
Clamp Hanger Subsystem	Two sets of clamp hangers with proximity sensors, two drive-pin assemblies and a lead screw

Table 2-1. EDS Phase 2 Physical Characteristics (Continued)

Component	Characteristic
Hydraulic Nut Subsystem	Two Grayloc® clamp halves attached to four threaded steel rods with hydraulic nuts
Helium Supply and Leak Detection Subsystem	Mounted on trailer
Agitation Subsystem	Rotates 360 degrees at 1 rpm for 15 rotations and then reverses for the same time and revolutions
Reagent Subsystem	
Supply Tanks	Two 65-gallon supply tanks with heaters. One tank holds water while the other tank holds reagent.
Pumps	Two double-diaphragm pumps each rated at 2 gpm (to supply tanks) Air-driven pumps, each rated at 3 gpm (to Containment Vessel)
Tank Heater	An 8-kW heater per tank
Dimensions of Secondary Containment Pan	72.34 inches long x 58.69 inches wide x 5.81 inches deep (approximately 106 gallons)
Waste Transfer Subsystem	Four waste drums will be used in the operation: Drums 1 and 1A for effluents from the Containment Vessel; Drum 2 will be used to capture vapors from Drums 1 and 1A. Drum 3 will be used for effluents from secondary containment pans/sumps. Each drum is provided with secondary spill containment.
Electrical Subsystem	Two 480-volt distribution panels and two 120-volt distribution panels for the trailers and their subsystem
Explosive Opening Subsystem	Two separate firing systems. Control module can be moved up to 350 feet from the firing system panel for remote operations.

Notes:

[a] Total net explosive weight including donor charges

FSS = Fragment Suppression System
gpm = gallons per minute
kW = kilowatt
rpm = revolutions per minute
TNT = trinitrotoluene

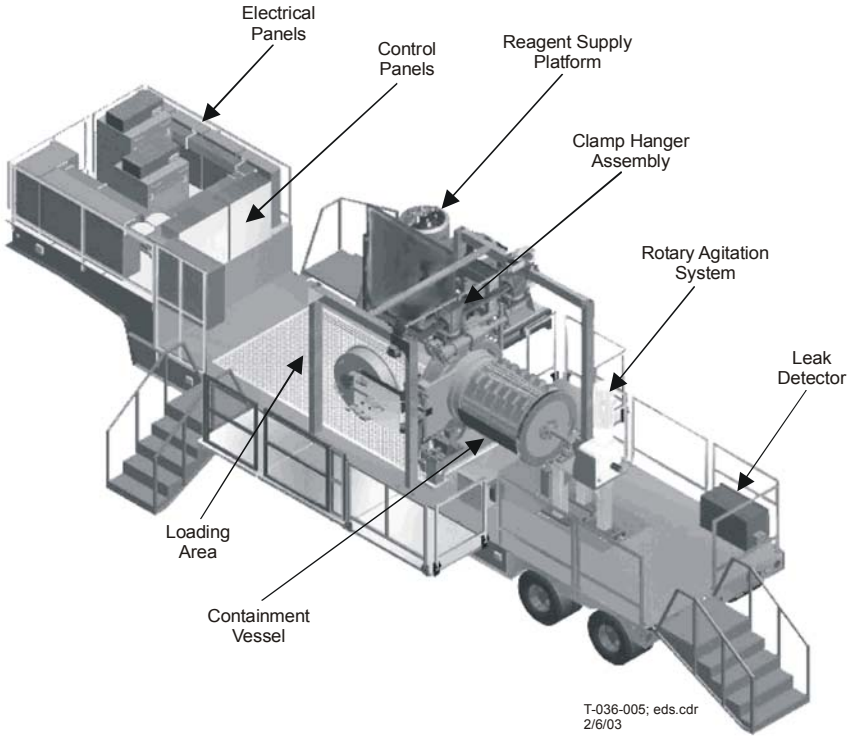

Figure 2-1. EDS Phase 2

- Hydraulic Nut Subsystem
- Helium Supply and Leak Detector Subsystem
- Rotary Agitation Subsystem
- Reagent Supply Subsystem
- Waste Transfer Subsystem
- Electrical Subsystem
- Explosive Opening Subsystem.

2.1.1.1 Trailer Subsystem. The primary components of the EDS Phase 2 are mounted on an 8-1/2 by 39-1/2 foot long perimeter frame single-drop trailer. The overall dimensions of the trailer in its operational configuration (including the stairs) are 20-1/2 by 45 feet. The overall height from the ground to the top of the trailer is approximately 12 feet. The working deck surface is 42 inches from the ground.

The front upper deck of the trailer (the gooseneck) houses the electrical enclosures; the lower deck is the working deck where the Containment Vessel is mounted. A secondary containment pan or sump is under the working deck. It is covered by SS grating, and has spray nozzles to flush it with water. A fold-out platform for the Reagent Supply Subsystem hinges at the edge of the working deck, has folding adjustable legs for support in the extended position, and has a secondary containment pan. Two hydraulic cylinders are used to lower the platform during operations and raise it during travel. An air-operated, double diaphragm pump is used to drain the secondary containment pans. The trailer has additional fold-out platforms on each side for personnel access around the vessel and the clamp hanger.

Trailer features include:

- *Materials and Paint.* All materials on or above the deck of the trailer are constructed of SS. All structural steel features and assemblies below the deck are undercoated with epoxy mastic and top-coated with epoxy enamel.

- *Stairs.* Three sets of SS stairs are used to access the trailer—one on each side of the working deck and one at the rear of the trailer. The stairs are hinged at the edge of the deck and raised onto the deck for travel. Raising and lowering the stairs is assisted by the use of air cylinders (shocks, not powered).

- *Leveling Jacks.* Four hydraulically-controlled leveling jacks are located under the trailer, two at the transition between the gooseneck and working deck on each side of the trailer, and the other two between the two rear axles.

- *Railings.* SS railings extend around the perimeter of the trailer. Some of the railings are removable to provide access to the working deck and others fold up for transport.

- *Tarp.* A two-piece vinyl tarp (supported by removable ribs) is used to cover the entire trailer down to the frame. The tarp is secured with hooks around the edge of the trailer during storage and transit.

- *Tie-Down Lugs.* Welded lugs on the trailer can be used to secure the trailer on an aircraft or a ship.

2.1.1.2 Containment Vessel Subsystem. The Containment Vessel is where the items(s) being destroyed is accessed and the chemical fill materiel is treated. The Containment Vessel is designed to contain the blast and fragments created when the explosive is detonated as well as prevent the release of chemical agent liquid or vapors.

The Containment Vessel Subsystem consists of the 316 SS vessel and door, door hinge, valve/sample panel, ethylene propylene diene monomer (EPDM) O-ring, Grayloc all-metal door seal, and vessel heaters with an insulated shroud. The Containment Vessel, fabricated by Grayloc Products, is designed to contain repeated detonations of up to a net explosive weight (NEW) of 4.8 pounds (trinitrotoluene [TNT] equivalent). The Containment Vessel body is an approximately 63-inch long cylinder with an inside diameter of approximately 29 inches and walls that are approximately 3 inches thick; the rear is approximately 6-1/2 inches thick. To aid in agitation, the interior of the vessel has two welded in-line T-shaped paddles (each 3-1/16 inches tall by 4 inches wide by

19 inches long). The vessel was designed and fabricated to American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, Division 1 (1995 Edition) and was tested to 4,200 pounds per square inch (psi) to provide a rated working pressure of 2,800 psi at 125°F (52°C).

The Containment Vessel door, hinged to provide interior access to the vessel's interior, is a 9-inch thick plate the same diameter as the vessel. Vessel door features include:

- *Door Hinge and Vessel Door Support Jack.* The door hinge assembly consists of the hinge pin, bushings, and adjustment screws for vessel door alignment. The vessel door support jack supports the weight of the door when opened. A mechanical interlock prevents the door from being open unless the jack is properly positioned.

- *Feedthroughs.* The door has four drilled-through machined ports for fluid, electrical, and diagnostic feedthroughs. Three of the vessel door feedthroughs are configured to accommodate fluids: (1) a fluid drain line port, (2) a gas sample/fluid inlet port, (3) and a liquid sample port. The inner threads of these ports are counter-bored into the door to protect the threads. The outer faces of these ports are machined to accept 3/8-inch high-temperature (450°F), medium-pressure (20,000 psi) packed-stem Autoclave™ valves with metal-to-metal seals.

  The inner face of the fluid drain line has a 1/2-inch diameter dip tube with a screen to prevent blockage of the port by solid wastes. The gas sample/fluid inlet port has a spray nozzle that is flush with the inner door surface. The liquid sample port line, when fitted with an adapter, has a 3/8-inch dip tube and can be used as a backup drain.

The fourth vessel door feedthrough is a 2-43/64-inch hole that is used for the electrical feedthroughs. Four to six electrical high-voltage feedthroughs are assembled on an 8-1/2-inch diameter by 2-3/4-inch thick SS flange that is secured to the door with eight 3/4-inch bolts and sealed using a Grayloc metal seal with an EPDM O-ring.

Although the feedthroughs were designed to minimize damage caused by fragment impact during detonation and vessel rotation, a door protector plate provides additional protection for the ports.

The vessel door also has a machined, in-place, thermowell for a standard thermocouple. The thermowell end is flush with the inside of the door. On the inner side of the door, a 2-inch deep, 1/2-inch radius countersink is machined around the end of the thermowell to improve temperature measurement.

- *Sample and Drain Assemblies.* A vapor sample valve assembly, a liquid sample valve assembly, and the drain port assembly are attached to their respective ports on the exterior of the vessel door. The two sample assemblies are mounted on horizontal slide brackets and have a shut-off quick-connect for the supply, helium, and vacuum hoses. The drain port assembly consists of two medium-pressure valves in series. A pressure transducer is located between these valves, and a quick-connect that connects to the vessel effluent hose is located after the second valve.

To aid in chemical treatment, the Containment Vessel and its contents are heated by six external 7.5-kilowatt (kW), 480-volt (V), single-phase band heaters. Power to the heaters is through a 50-ampere slip ring on the vessel rear end shaft. These band heaters are capable of heating the vessel contents up to 212°F (100°C). The temperature is set and monitored by a display on the vessel control panel. The

operators are protected from coming into direct contact with the Containment Vessel heaters and the Containment Vessel surface by an insulated shroud that surrounds the vessel and the band heaters.

2.1.1.3 Lift Assist Subsystem. The Lift Assist Subsystem is used to help the operator lift and position heavy objects to and from the ground to the EDS Phase 2 Containment Vessel. This subsystem consists of an overhead jib crane and an intelligent lift device mounted to the overhead clamp support frame on the EDS Phase 2 trailer platform. The jib crane, which is rated for 650 pounds, has two articulated arms affixed in tandem to a vertical member of the overhead clamp support frame. The arms have two passive (non-motorized) joints to allow the jib crane to horizontally traverse an area with a radius of 8 feet under human power. At the end of the jib crane is a Stanley iLift™ hoist, which is a computer-controlled electric hoist containing a load cell to quantify the speed and direction of the vertical motion required by the operator to lift an item. The load cell senses the manual force exerted by the operator and amplifies the force to lift items weighing up to a maximum of 500 pounds. The Stanley iLift hoist is removed from the overhead jib crane for transportation.

2.1.1.4 Clamp Hanger Subsystem. The Clamp Hanger Subsystem is used for opening and closing the vessel door clamps and supporting the weight of the Containment Vessel door clamps while the door is open. This subsystem consists of two clamp hanger assemblies (one for each clamp half) with proximity sensors, two drive pin assemblies that each attach to a clamp hanger assembly and a lead screw with an electric drive motor, weight supporting structure, a control panel, and a pendant control.

2.1.1.5 Hydraulic Nut Subsystem. Hydraulic nuts provide the required pre-load on the Containment Vessel clamps to ensure gas-tight vessel operation. Once the Containment Vessel door is closed, knurled nuts on the ends of the threaded rods are turned by hand until the initial required gap is obtained between the clamps. The clamps are closed to the final required gap by use of the hydraulic nuts, which provide

the required pre-load on the vessel clamp to ensure gas-tight vessel operation. The hydraulic nut pump supplies hydraulic pressure to the hydraulic nuts to load or stretch the threaded rods axially. Once the required load or stretch is achieved, locking rings are hand-tightened against the hydraulic nuts to retain the load, the hydraulic pressure is released, and the hydraulic line is then disconnected. The hydraulic nut pump is operated from the Containment Vessel control panel or a pendant control.

Releasing the hydraulic nut pressure from the clamps is carried out by repressurizing the hydraulic nuts with a higher pressure and backing the locking rings off the four nuts. Following release of the pressure, the knurled nuts are manually loosened.

2.1.1.6 Helium Supply and Leak Detector Subsystem. The Helium Supply and Leak Detector Subsystem is used to test the integrity of the Grayloc seal and EPDM O-rings by monitoring the helium leak rate between the seal and the O-ring. It is comprised of a commercial helium gas cylinder, two pressure regulators with gauges, tubing to transfer helium from the helium gas cylinder to the Containment Vessel, and a helium leak detector connected by tubing to vacuum flanges on the Containment Vessel door and the high-voltage feedthrough flange. The helium leak detector is normally operated via a hand-held remote control but can also be operated using the instrumentation panel on the helium leak detector. Helium is also used to assist draining and to flush the Containment Vessel interior after munition or item treatment prior to opening the Containment Vessel door.

2.1.1.7 Rotary Agitation Subsystem. The Rotary Agitation Subsystem is a mechanical system that is used to mix the Containment Vessel contents during chemical treatment. The Containment Vessel, which is supported on casters, is rotated using a rotary drive system mounted behind the vessel and attached to the vessel by a shaft with a coupler. It consists of a 3 horsepower, 480 V, 3-phase motor, with a gearbox and variable frequency drive, and a process controller. This subsystem is operated from the vessel control panel or a pendant control. The vessel automatically rotates at a speed of

1 revolution per minute (maximum speed is 1.9 revolutions per minute). The absolute encoder tracks the vessel movement so that if halted in mid-cycle, the rotation is restarted in the direction and for the number of rotations required to complete the cycle.

2.1.1.8 Reagent Supply Subsystem. The Reagent Supply Subsystem is comprised of two 65-gallon (246-liter) 316 SS tanks known as Tank 1 and Tank 2 and is used to supply reagents used for chemical treatment and water used for rinsing. Tank 1 is intended for water and Tank 2 is intended for reagents. Each tank has an external heater (8 kW, 480 V) on the bottom to heat their contents. Insulated shrouds are used to protect the workers from coming in direct contact with the hot tanks. Each tank has a temperature controller located on the process control panel, and the temperature in each tank is measured by a thermocouple. The tanks are ASME-rated for 60 psi at 212°F, but operate at atmospheric pressure. Magnetic float level gauges provide a visual indication of the liquid level, and a low-level switch with alarm cuts power to the tank heaters when activated.

Two air-operated double diaphragm pumps are used to transfer reagent and water into their respective supply tanks. The water pump is also used to supply water to the nozzles in the secondary containment pan.

Both tanks can be rinsed or filled with water through a spray nozzle located at the top of each tank. Reagent is normally supplied to the reagent supply tank from the bottom of the tank. Air-driven pumps are used to transfer the reagent or water from the supply tanks to the Containment Vessel through 316 SS tubing. The final connections between the piping and the Containment Vessel are by Teflon®-lined braided SS flex hoses. The reagent supply panel contains the valves that control the Reagent Supply Subsystem, and the adjacent hose docking station holds the various hoses during vessel rotation.

2.1.1.9 Waste Transfer Subsystem. The Waste Transfer Subsystem conveys liquid waste generated during the chemical treatment and water rinses into 55-gallon waste

drums. The liquid wastes are transferred from the Containment Vessel through Teflon-lined braided SS flex hoses connected to one of the bungs on the liquid waste drum. Each drum is protected from overpressurization by a 10-psi rupture disc. In the event of a disc rupture, an alarm sounds and a valve automatically closes to halt the flow into the waste drum.

Two liquid waste drums (waste drums 1 and 1A) are connected to a three-way selector valve in the drain line from the vessel. When treatment is complete, the valve is switched to fill the first drum (waste drum 1) with waste neutralent and the second drum (waste drum 1A) with water rinses. Any air emissions during liquid waste transfer are controlled by an in-line carbon filter assembly (a carbon filter canister) mounted on waste drum 2 and exhausted through the air filtration system carbon filter unit of the EE. Drum 3 is used to collect any liquids that have collected in the secondary containment pans.

Liquid waste drums are provided with secondary containment and are placed on mechanical 1,000-pound capacity scales. An open-top drum is used for solid wastes. Management of all EDS wastes, including spent carbon filters, is discussed in **Annex F**, Waste Management Plan.

2.1.1.10 Electrical Subsystem. The Electrical Subsystem provides the required 480 V, 3-phase electrical power for the vessel, supply tank heaters, rotary agitation, and drive motor. Conditioned 120 V power is supplied to other subsystems. Electrical power can be supplied by utility power (130-ampere minimum) or by a generator (178 kW, 480 V mobile generator). During operations, the electrical load is normally 54 to 70 kilovolt amperes (kVA) (maximum of 123 kVA), and the system draws between 40 to 70 amperes (maximum of 126 amperes). Electrical enclosures in the process area meet the National Electrical Manufacturers Association (NEMA) 4X requirements for outdoor and corrosive use; all others are specified as NEMA 4 for outdoor use. The heating and monitoring system for the supply tanks is designed to meet National

Electrical Code Class 1, Division 2 Area Classification. Electrical Subsystem features include:

- *Power Distribution.* The main 480 V power distribution panel distributes necessary power to 480 V process equipment. A 30 kVA transformer steps down the 480 V to 208/120 V, and a second power distribution panel distributes power to 120 V process equipment and utility systems.

- *Grounding.* All electrical and mechanical equipment is grounded through a bonding system on the trailer frame to a common ground.

- *Utilities.* Several dedicated 110 V receptacles and some with ground fault circuit interrupters are installed throughout the trailer. One receptacle is dedicated and labeled as "Sensitive Equipment Only."

2.1.1.11 Explosive Opening Subsystem. The Explosive Opening Subsystem consists of the FSS, the Firing System, and donor charges. Donor charges are used to access the munition or item fill, thereby releasing the chemical fill into the Containment Vessel. The donor charges are also used in destroying the munition burster explosive (if present).

a. *FSS.* The FSS is a structural framework designed to hold one to six munitions and serves to connect, hold, and align the explosive charges used for munition opening and burster charge detonation. It also protects the interior surfaces of the Containment Vessel from the high velocity fragments from the shaped charges, burster casing, and munition(s) or item(s). The FSS is composed of 1018 carbon steel and is an expendable component.

b. *Donor (Explosive) Charges.* Donor charges consist of linear-shaped charges (LSCs) and conical-shaped charges (CSCs). The LSCs are used to access the main body of the munition or item to expose the contents for chemical treatment. The primary requirement, cutting the walls of the munition(s) or item(s), is accomplished with pre-formed length(s) of copper-sheathed LSC with a cyclonite (RDX)-based-explosive filler. The shape, length, and grains per foot of the LSC are specific for the type of munition(s) or item(s) to be treated. For multiple munitions, the LSCs are also used to disrupt the explosive train of the munitions.

CSCs are used to puncture a munition burster and detonate the burster explosives. Depending on the munition type and the X-ray results for the munition, one or two CSCs are positioned on the upper shell of the FSS above the munition. CSCs are not used with multiple munitions and not always with single munitions.

c. *Detonators.* Detonators are used to simultaneously initiate donor charges. The firing system is used to simultaneously initiate the donor charges. The detonators used to initiate the LSCs are Reynolds type RP-1® exploding bridge-wire detonators; RP-2® detonators are used for the CSCs. These detonators are insensitive to unexpected or undesirable energy inputs (static, impact, etc.) and are detonated by the discharge of high current through the bridge-wire. The bridge-wire explodes and produces a shock wave, which, in turn, initiates the explosive in the shaped charges.

d. *Firing System.* The firing system is a high-voltage capacitor discharge unit designed to reliably fire four to six exploding bridge-wire detonators. The firing system is connected to the detonators in the Containment Vessel using 50-foot detonator cables, and is remotely operated through a

detachable control module that allows the operator to arm and fire the firing system from up to 350 feet away. The firing system includes various features necessary to safely fire the detonators and to test and monitor the system and detonator cables. One of these features is a safety interlock plug to prevent inadvertent operation of the system.

2.2 Environmental Enclosure

The EDS will be located inside an EE comprised of a ceiling, sides, and flooring that will provide weather protection and interior environmental control for the workers' comfort and safety. The floor of the EE will be a concrete pad covered with impermeable plastic sheeting. The structure also provides secondary vapor containment during EDS operations in the event an unexpected release of chemical agent occurs during loading of the items.

The EE will have an air filtration system that will maintain a negative pressure within the EE relative to the outside air and will capture any chemical fill vapors resulting from operations. The air filtration system will remain on at all times.

The air filtration system for the EE consists of prefilters, HEPA filters, and carbon filters along with a monitor, port fan, and ductwork. Two chemical air filtration systems will be used. Each system houses two banks of carbon filters, two banks of HEPA filters, and one bank of prefilters. Each bank contains nine 18-inch filters. First-time use filters that have never been exposed to chemical agent will be used in this EDS operation.

A smoke test will be conducted on initial setup to certify the air filtration system and to check airflow velocity to ensure that the EE is able to maintain negative pressure inside the structure relative to the outside air. The size of the carbon filtration unit is adequate to adsorb any chemical agent that could be released from a leaking munition or item. For example, a bank of carbon filters can adsorb up to 240 pounds of HD, a value that

is many times more than what is contained in a single HD munition or bottle to be treated.

2.2.1 Design. The type of EE that will be used at DPG is a Vapor Containment Structure (VCS).

The VCS is a fully-enclosed pre-engineered steel building constructed of a series of modular Galvalume® ribbed panels bolted together to form the structure.

The VCS meets the following codes:

- National Fire Protection Association (NFPA) 701, *Fire Tests for Flame Resistant Textiles and Film*
- Uniform Building Code (UBC) 31-1, *Flame Retardant Membranes*
- Underwriters Laboratory (UL)-214, *Tests for Flame-Propagation of Fabrics and Films*
- American Society for Testing and Materials (ASTM)-E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*.

The VCS will be 30 feet wide by 50 feet long by 16 feet 10 inches high. The structure is assembled by bolting together 2x10-foot preformed 14 gauge Galvalume panels that are also bolted to a W8x18 steel beam base. The structure will be equipped with a 12x12-foot roll-up door centered in one end. Standard personnel doors will be located on both ends of the structure. A 2x2-foot circular opening will be in one end of the arch for connection to the filtration system and a 3x3-foot louvered opening will be in the opposite end of the structure for providing makeup air. A layer of impermeable plastic

sheeting will be placed inside the VCS and turned up at the VCS walls to prevent spills from contaminating the soil, surface water, or groundwater.

2.2.2 Security Requirements. CWM will not be stored in the EE. The doors to the EE will be equipped with locks that will be locked when personnel are not onsite. Physical security will be provided to this site in accordance with DPG policy.

2.3 Other Support Equipment

2.3.1 Operational Command Post. An operational Command Post trailer will be located at the EDS site and will be equipped with the necessary computers and communications equipment to control operations and perform data collection functions.

2.3.2 Generators. Electrical power for the entire EDS site will be provided by four diesel-powered generators, two primary and two as a backup power supply for critical systems should the primary generators fail.

2.3.3 Air Monitoring Shelter. Air monitoring equipment will be housed in a shed/trailer with sampling lines running to the various sampling points around the EDS.

2.3.4 Air Compressors. Separate air compressors supply air to power the transfer pumps that pump liquids into the EDS Containment Vessel and any liquid wastes out of the EDS trailer secondary containment pan; and to supply air for the self-contained breathing apparatus (SCBA) tanks.

2.3.5 Air Cascade System. Breathing air for emergency operations will be provided by a cascading air system.

2.3.6 Mobile Chemical Laboratory. A mobile chemical laboratory will be set up at the EDS site to provide air and liquid sample analysis services.

2.3.7 Plumbing. The EDS site does not require connection to a water supply or sewer system. Drinking water will be provided in designated break areas. DPG will provide water for operation of the EDS and PDS and will be stored in tanks. Liquid wastes generated in the PDS will be containerized.

2.3.8 Donor Charges Storage. Explosive donor charges used during EDS operations will be stored in accordance with Department of the Army (DA) policy and brought to the EDS as needed per DoD 6055.09-STD.

2.3.9 PDS. A PDS will be set up in accordance with the site-specific SHERP for personnel to remove personal protective equipment (PPE) when leaving the exclusion zone.

2.3.10 PPE Change Area. Facilities will be provided for personnel to don PPE and to shower after passing through the PDS.

2.3.11 Break Room Area/Crew Trailer. A break room area/crew trailer will be provided for onsite personnel.

2.3.12 Observation Area. An observation area, equipped with closed-circuit television, will be provided so the destruction process can be monitored without having to enter the exclusion zone.

2.3.13 Toilet Facilities. DPG will provide portable toilet facilities for onsite personnel.

2.3.14 Uninterruptible Power Supply (UPS). All monitoring equipment will be connected to a UPS. All other site equipment (including the air filtration system) will be powered by the back-up generators, if the primary set of generators fail.

2.4 Recommended Meteorological Conditions

Movement of the munition(s) or item(s) from the storage site to the EDS and loading it into the EDS will be halted or postponed if severe weather conditions (such as a tornado or lightning) threaten. Operations personnel will check the local meteorological forecast to ensure that acceptable conditions exist and are not expected to change during the time needed to load the munition(s) or item(s) into the EDS Containment Vessel. Operations will be scheduled for a day when the predicted weather conditions preclude the distance to no chemical agent effects from reaching beyond the maximum credible event (MCE) calculated distance or reaching a sensitive offsite target. If, on the scheduled day, weather conditions, such as wind direction or atmospheric stability, unexpectedly cause the distance to no chemical agent effects to extend beyond the MCE hazard distance or reach a sensitive offsite target, the EDS System Manager may delay or postpone operations until weather conditions again become favorable.
Note: The MCE calculated hazard distance only applies to handling the munition or item outside the EDS. Once the munition(s) or item(s) is sealed inside the EDS Containment Vessel, the blast, fragmentation, and chemical agent hazards are confined to the interior of the EDS Containment Vessel.

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SECTION 3
OPERATIONS

This section presents a general description of the EDS operations (along with identifying the associated procedure) and the hazard distances associated with these operations.

The EDS will be operated in accordance with approved Standing Operating Procedures (SOPs). An operating order will be created for each munition or item, or set of munitions or items, that will be destroyed. The actual operating order will be located inside the Command Post during destruction operations. **Figure 3-1** presents a simplified process flow diagram for EDS operations.

The 4.2-inch mortars and miscellaneous chemical samples will be destroyed and chemically treated in a multiple configuration. All other items may either be individually destroyed and chemically treated or combined with other items with the same chemical fills and destroyed via a multiple configuration.

3.1 EDS Functional Description

3.1.1 Setup (EDS SOP Procedures 1, 2, and 3). Upon arrival at the treatment location, the EDS and associated support equipment are set up, inspected, and prepared for operations. During setup, a polyvinyl barrier sheet is placed under and around the EDS trailer. If electrical power is not available from a nearby utility power source, an electrical generator is used. Any necessary equipment/instrument calibrations are performed.

After the EDS has been set up and inspected, approved baseline monitoring studies are completed by ECBC personnel in accordance with Site-Specific Monitoring Plan requirements. Prior to starting operations, a Pre-Operational Survey is conducted.

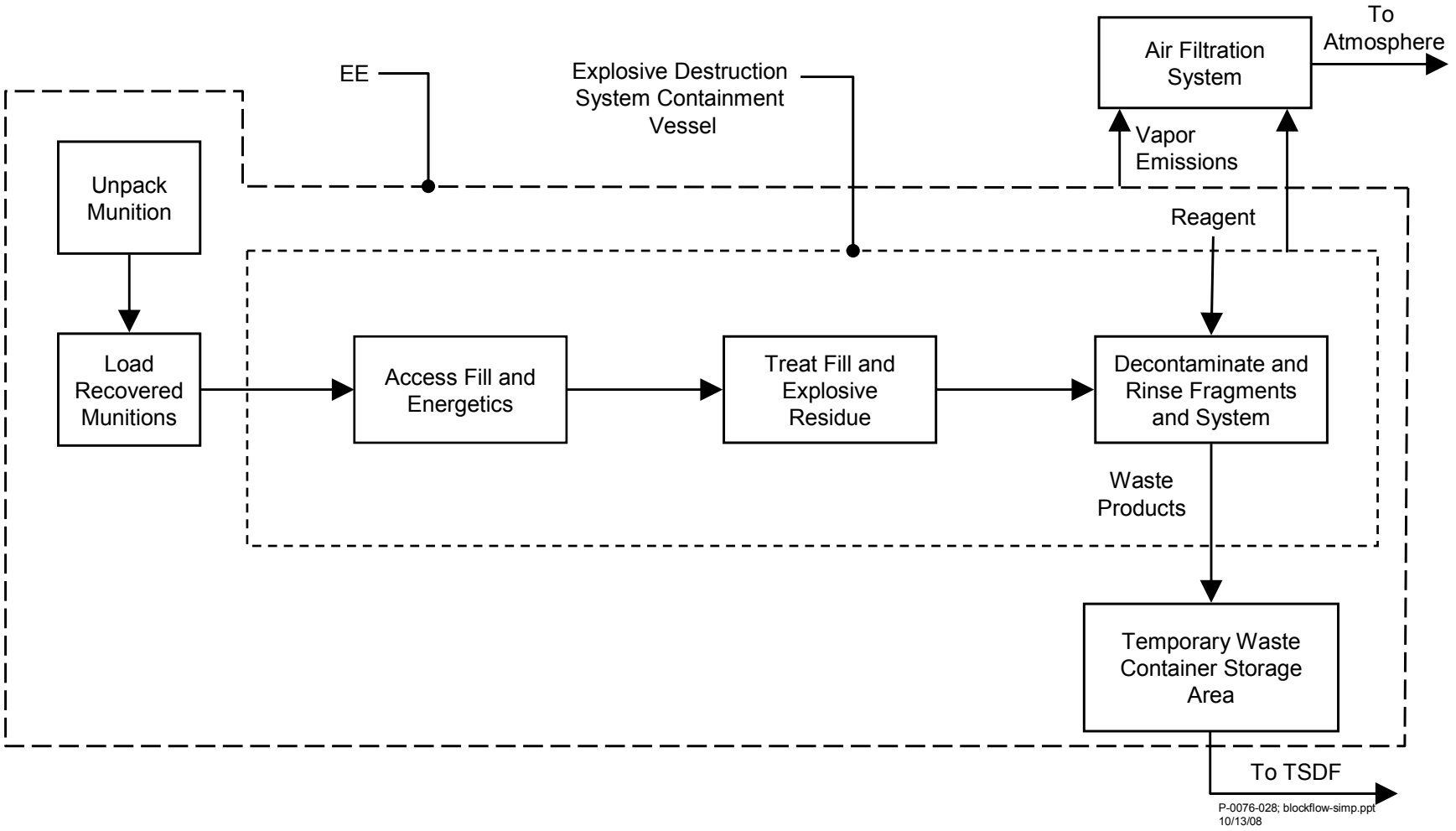

Figure 3-1. Simplified Process Flow Diagram for EDS

3.1.2 Accessing Munitions or Items with Shaped Charges (EDS SOP Procedures 4, 5, 6, 7, 9, and 10). The munition(s) or item(s) to be destroyed is transported to the EDS, unpacked, and placed into a munition or item holder located in the cylinder bottom of the FSS. The LSC(s) is placed onto the munition holder and the cylinder top of the FSS is placed on the cylinder bottom. CSCs, when used, are placed on the cylinder top of the FSS. The pre-checked detonators are attached to the charges and electrically shorted for safety.

Once the entire assembly (munition[s] or item[s] to be destroyed, FSS, shaped charges) has been placed inside the Containment Vessel, the final detonator connection is made using the interior detonator jack. With a clean, dry lubricated sealing surface, the Grayloc seal mounted on the Containment Vessel's sealing surface, and the EPDM O-ring properly seated in the door, the door is closed and the door clamps are pushed closed. The knurled nuts are first tightened using wrenches and then by hydraulic pressure.

The proper installation of the Grayloc seals on the Containment Vessel door and the high-voltage flange are then confirmed by helium leak testing. Afterwards, the firing sequence is initiated and the explosives are detonated.

3.1.3 Chemical Treatment (EDS SOP Procedures 3, 12, 13, 14, 15, 16, 17, and 18). Treatment of the chemical agent and decontamination of the munition or item fragments is accomplished within the sealed Containment Vessel. Appropriate reagent is pumped/sprayed from the reagent supply tank into the Containment Vessel to treat the chemical fill. The reagents used for chemical treatment and the chemical treatment details are listed in **Table 3-1**.

For example, when processing mustard-filled items, the Containment Vessel is heated to 60°C ±5 degrees and agitated after the addition of the 90 percent monoethanolamine (MEA) reagent (preheated to 60°C ±5 degrees). A neutralent sample is collected for analysis and vessel agitation is restarted. The first neutralent sample will be collected

Table 3-1. Chemical Treatment Details

Fill Type	Reagent	Treatment Level, mg/L[a]
HD, HT[b]	90 vol.% MEA	50
GB[b]	45 vol.% MEA	1
GD[b]	45 vol.% MEA	1
VX[b]	MEA/NaOH[c]	50
Empty[d]	Water	50 (HD)

Notes:

[a] Treatment level will be determined by chemical analysis.
[b] Chemical treatment is followed by a 100°C water rinse.
[c] 9 parts 90 percent by volume MEA, 1 part 50-percent by weight NaOH
[d] "Empty" denotes the munitions identified as no known elements. These empty munitions will be treated with hot water followed by a single ambient water rinse.

GB = sarin
GD = soman
HD = distilled sulfur mustard
HT = thickened mustard
MEA = monoethanolamine
mg/L = milligram per liter
NaOH = sodium hydroxide
vol.% = volume percent
VX = O-ethyl S-(2-diisopropylaminoethyl)methylphosphonothioate

after 1 hour of agitation. Depending on the analytical results, additional sampling will be conducted at various intervals (of 30 minutes to 1 hour) until results indicate that the treatment level has been met.

If the sample results meet the treatment level, chemical treatment is considered complete.

The neutralent is then drained into a waste drum and the Containment Vessel is rinsed with clean water from the water supply tank. The first water rinse is preheated to 60°C ±5 degrees and then heated to 100°C inside the Containment Vessel with continued agitation for 2 hours after the Containment Vessel contents reach 100°C. A second rinse is performed using ambient temperature water. The rinsates are drained into a separate waste drum. The Containment Vessel is then flushed with helium and a headspace vapor sample is collected to verify that chemical agent vapor concentration in the vessel is below hazardous levels before opening the vessel door.

A debris pan is used to catch any liquids and parts from the Containment Vessel when the door is opened and the metal parts and fragments are removed. The debris pan measures approximately 52 inches long x 30 inches wide x 11.5 inches deep, and can hold up to 50 gallons. The solid wastes are visually inspected, removed from the Containment Vessel, placed into a waste container, and sealed. Should any explosive components be found, they are segregated from the other solid wastes and held for subsequent detonation within the Containment Vessel. The Containment Vessel is cleaned to remove any remaining solid debris. Drums containing waste products are stored and managed as hazardous waste.

3.1.4 Preparation for Next Munition or Item (EDS SOP Procedure 19). Before treating subsequent munition(s) or item(s), the Containment Vessel is systematically cleaned and inspected. This process includes visually inspecting the vessel, its sealing

surface, and its door; making any necessary repairs; replacing the door seal and EPDM O-ring on the vessel door; and replacing the electrical feedthroughs, as necessary.

After approximately every fifth item treated, the following maintenance is performed: inspect the containment system, inspect and leak test the sample panel, inspect rotary agitation system, inspect reagent supply system, inspect the ball valve, and inspect electrical power cables and cords. Any identified deficiencies are repaired before proceeding with the next destruction operation.

3.1.5 Closeout (EDS SOP Procedures 20, 21, and 22). On completing EDS operations, the EDS is closed out. Closeout activities are detailed in **Annex L** of this Destruction Plan.

3.2 Hazard Distance

The EDS Containment Vessel has been demonstrated to contain the chemical agent, blast, and fragments released when the munition(s) or item(s) is destroyed and the fill treated. However, before the munition or item has been placed inside the Containment Vessel, there are potential hazards to which the workers, public, and environment could be exposed. To determine potential hazard distances, the hazard posed by the chemical agent fill and the hazard posed by the explosives contained in the munition(s) or item(s) or used to operate the EDS are considered separately.

Chemical agent and explosive hazard distances and movement of munitions or items to the EDS are detailed in **Annex B**.

3.3 Field Measurements

Field measurements are detailed in **Annex H**, Quality Assurance Project Plan, of this Destruction Plan.

3.4 Monitoring

The following types of monitoring will be conducted during EDS operations at DPG.

3.4.1 Air Monitoring. Air monitoring is conducted to ensure that the EDS operations are performed safely. The primary objective of air monitoring is to detect conditions that may cause workers to be exposed to chemical agent vapors. Workplace exposure levels for chemical agents are listed in the Site-Specific Monitoring Plan (**Annex E** of this EDS Destruction Plan), as well as air monitoring strategies and equipment.

3.4.2 Pressure Monitoring. Initial filter testing will establish baseline pressure drops for each bank of filters in the air filtration system. Pressure readings will be collected each day (as part of the preoperational checklist) and compared against baseline readings. The filter system will be inspected and filters will be changed out if necessary, if those readings fall to half or rise to double the established baseline. Any confirmed MINICAMS readings at the carbon filter system midbed will result in changeout of the first bank of carbon filters.

3.4.3 Gas-flow Monitoring. Flowmeters are used to measure air or gas flow for specific equipment (for example, MINICAMS®) to ensure that the equipment is operating within specified parameters.

3.4.4 Relative Humidity and Temperature. Relative humidity and temperature will be monitored in the EE to ensure conditions appropriate to operator safety are maintained. Guidelines for operator safety are summarized in **Appendices E** and **F** of the Safety, Health, and Emergency Response Plan (**Annex I** of this Destruction Plan).

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SECTION 4
ORGANIZATION

The principal organizations involved in implementing this Plan include DPG, PMNSCM, ECBC, and West Desert Test Center (WDTC). The organization for EDS operations is shown in **Figure 4-1**. Command and control of EDS personnel is shown in **Figure 4-2**.

PMNSCM will provide the EDS and will control operations to ensure that destruction is conducted in a safe and environmentally acceptable manner. ECBC will provide EDS operators who will perform the destruction procedure. ECBC also will perform air monitoring. DPG will provide support services as needed (for example, medical support and security). Each agency is responsible for providing the supplies and equipment needed for carrying out agency-specific responsibilities.

All support and operational elements will be briefed on the nature of the operation before the item is moved from DPG Igloo G to the EDS site for destruction and treatment of the fill material. Personnel and equipment necessary to conduct the operation will be properly positioned. When the PMNSCM EDS System Manager verifies personnel and equipment are in place, destruction will be initiated. The EDS System Manager and EDS Crew Chief maintain control and authority for EDS operations and personnel. The EDS System Manager, in conjunction with the EDS Crew Chief, will conduct daily safety briefings.

4.1 DPG

DPG is the supported agency and maintains control of the site at all times. In addition, DPG will coordinate with state regulatory agencies, DA Safety, and DDESB for approval of this Plan.

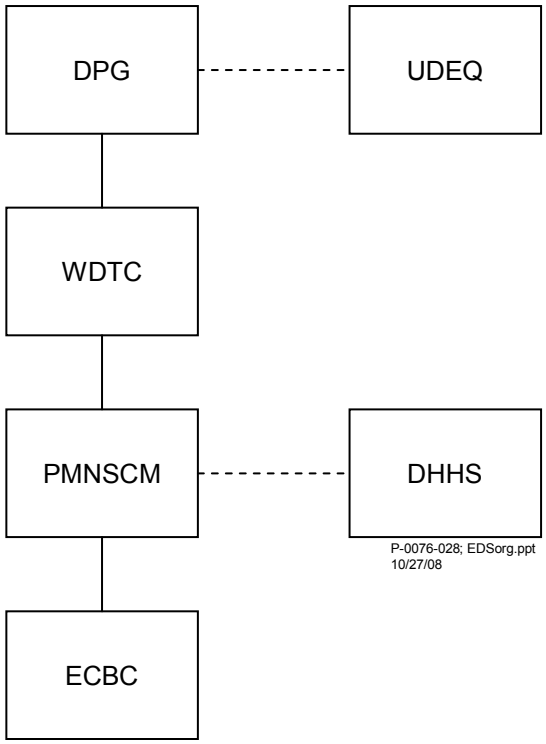

Figure 4-1. Organization for EDS Operations at DPG

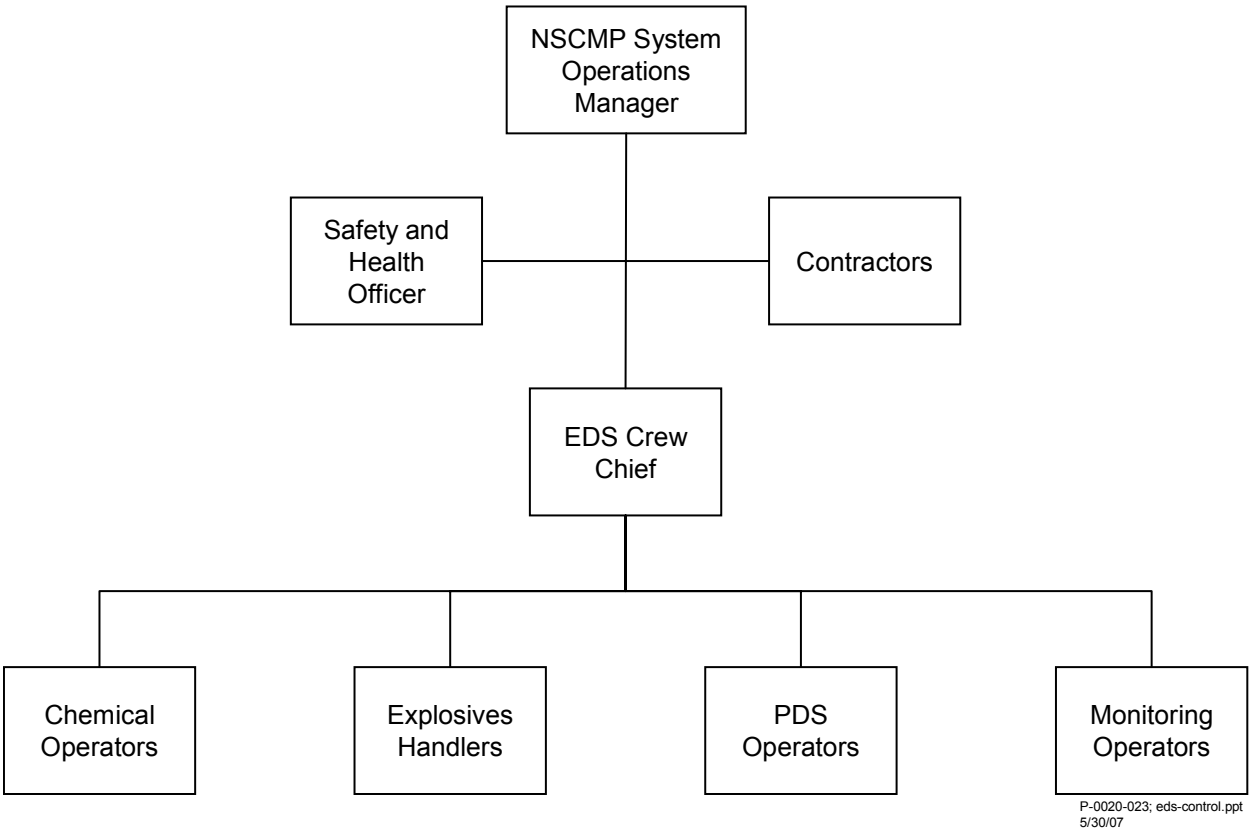

Figure 4-2. EDS Command and Control

DPG will have the lead for public outreach pertaining to the destruction of items at DPG and provide logistical support relating to site access/preparation medical support, fire protection, and security.

4.2 UDEQ

UDEQ will provide environmental regulatory oversight of the EDS operation at DPG. The EDS operation at DPG will be conducted under a Stipulation and Consent Order issued by the Utah Solid and Hazardous Waste Control Board.

4.3 PMNSCM

PMNSCM has programmatic responsibility for the destruction of recovered CWM. PMNSCM will support EDS operations by preparing this Destruction Plan, providing the EDS, and funding the operation. PMNSCM will control and manage all EDS operations. The NSCMP System Operations Manager or designee will be onsite during operations and will be responsible for coordinating with WDTC and DPG representatives.

4.4 ECBC

ECBC is the operator of the EDS under direction of the PMNSCM System Manager. ECBC will provide an EDS Crew Chief and will provide equipment and personnel for chemical agent monitoring of the EDS work area. ECBC will coordinate operations and manning of the PDS. ECBC will provide trained and certified explosives handlers.

SECTION 5
RESULTS OF HAZARD ANALYSIS

Procedures described in this Destruction Plan were evaluated in accordance with the *Non-Stockpile Chemical Materiel Product System Safety Management Plan* (PMCD, 2001b). The assessment concluded that the items slated for destruction in the EDS at DPG could be destroyed safely. The hazard analysis is provided in **Annex B** of this Destruction Plan.

The MCE for this operation was determined to be the evaporative release of 2,067 milliliters (mL) release of GB from a DOT bottle.

The HA identified 11 hazards. Ten were assigned a controlled risk assessment code (RAC) 3 and are acceptable upon review by the System Safety Program Manager. One hazard (001 in **Attachment B-1** of **Annex B**) is a RAC 2 and has been accepted by the PMNSCM.

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